



IN THE U.S. PATENT AND TRADEMARK OFFICE,

Appl. No. : 10/740,036
Applicant : Yoshiya Hirase
Filed : December 18, 2003
TC/AU : 2195
Examiner : Zhe, Meng Yao

Docket No. : 883.0005.U1(US)
Customer No. : 29683

Title : **TIERED MULTI-MEDIA ACCELERATION SCHEDULER
ARCHITECTURE FOR DYNAMIC CONFIGURABLE DEVICES**

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

DECLARATION UNDER 37 C.F.R. § 1.131

1. I Yoshiya Hirase hereby attest that I am the first inventor of the invention described and claimed in the above-referenced patent application now pending before the U.S. Patent Office.

2. I conceived of the invention as described in Exhibit A at least as early as December 13, 2002 and the inventive activity occurred in a US/NAFTA/WIPO country. Exhibit A is my invention report which was presented internally for Evaluation by Nokia in Oulu, Finland at least by December 13, 2002 as evidenced by the date stamp in the footnote area of the filename.ppt pages 1-4 of Exhibit A.

3. I hereby attest that the Exhibit cited herein is a true copy. I hereby acknowledge that the statements made herein are true or are made on information and belief that is believed to be true. I further acknowledge that any willful false statements are punishable by fine or imprisonment, or both, in accordance with 18 U.S.C. § 1001; and that such false statements may jeopardize the validity of any patent that may issue from the application to which this Declaration pertains.

Respectfully Submitted,

Yoshiya Hirase
Yoshiya Hirase

Jan 24, 2008
Date

Nokia Research Center, Japan

INVENTION REPORT

1

Title of Invention: Tired Multi-media Acceleration Scheduler Architecture for dynamic configurable devices

Please answer the questions on the next page

2

INVENTION REPORT RECEIVED

Code: Classn: Rating:

Place: Date:

Signature:

3

COMPLETED BY MANAGER

Project/Line Manager Name:

I have read and understood this Invention Report disclosure and I agree with the name(s) of the inventor(s).

Signature:

Date:

Please complete the attached evaluation form on page 3 and sign and date all the pages of the disclosure.

Enclosures:

Disclosure of invention ☐

Prior art documents ☐

Other

In my/our opinion the invention belongs to category:* (See page 4)

(Not necessary to fill in)

N/A

The invention becomes public on:

I/we consider the invention to belong to the category indicated above and to my/our best knowledge.

I am/we are the sole/and original inventor(s) of this invention.

Signature of inventor(s):

Date / 200?

EXHIBIT A

Nokia Research Center, Japan

INSTRUCTIONS FOR COMPLETING THE INVENTION REPORT

This invention report is used in cases where an invention has been made by an employee/contractor of the **COMPANY**. This invention report is **confidential**. Only the patent personnel are allowed to make copies of the signed invention reports in order to request opinions or reply to the inventor(s).

The signed invention report is to be given to the Project or Line Manager of the inventor. The Manager checks that the invention report has been described in a comprehensive manner. The Manager completes field 3 on the first page of the invention report, **signs ALL the pages of the disclosure and completes the evaluation form. The Manager should sign the evaluation on page 3, and sign Section 3 on page 1.** Thereafter the Manager sends the invention report to the Patent Department.

*** INVENTION CATEGORIES****CATEGORY A**

The exploitation of the invention is related to the COMPANY'S field of activities, and the invention resulted from an activity connected with the employee's normal duties, or essentially from exploitation of the experience obtained in the business or premises of the COMPANY, or the exploitation of the invention is not related to the field of activities of the COMPANY but the invention was made as a result of other, more specific duties assigned to the inventor at his/her work.

CATEGORY B

The exploitation of the invention is related to the COMPANY'S field of activities, and the invention was made in connection with the employment of the inventor, but in other connection than those mentioned in CATEGORY A.

CATEGORY C

The exploitation of the invention is related to the COMPANY'S field of activities, but the invention was made without any connection with the employment of the inventor.

CATEGORY D

The invention is not included in CATEGORIES A, B or C.

Please return the original completed form duly signed by inventors to:

Patent Department,
Nokia Japan Co.,Ltd.
Akasaka 81 Bldg. Tokyo

Nokia Research Center, Japan

1. This invention proposes an essential architecture to exploit the capability of dynamic configurable devices to accelerate multi-media application software for mobile terminals. The basic idea is a two layered scheduler named 'TirEd Multi-media Acceleration Scheduler' (hereinafter TEMAS)', which copes with dynamic configurable hardware logic (hereinafter DCHL) on generic system software (See Figure 1, Figure 2). At this moment, configurable hardware have not been implemented into commercial mobile terminals due to maturity of the technology, but future generation's products require such as hardware in order to reduce power dissipation and extend adaptability to new applications. This invention introduces the core software architecture for future terminals.
2. See Figure 1.
3. The majority of multi-media applications such as MP3 player or movie players are working on a generic operating system (hereinafter OS), not real-time operating system. For examples, popular commercial products like SymbianOS or PocketPC are also categorized in such OS. Under such an OS, Applications are scheduled using a heuristic algorithm, which brings that which application to be scheduled is unpredictable. In this case, scheduling of DCHL occurs asynchronously, and any optimal methods to improve the performance of CL can't be conducted. The proposed architecture of scheduler enables to introduce improvement methods such as 'preloading' or 'configuration compression'.
4. At this moment, since DCHL has been used at research fields, not commercial products, no same architecture has been introduced to overcome the target problem because research activities has been mainly conducted to propose hardware architecture. Some studies use one layered scheduler to schedule algorithm logics because it is for dedicated hardware architecture, not generic one. Some methods such as 'preloading' or 'configuration compression' to improve potential of DCHL are proposed as studies from the hardware point of view.
5. The advantage of this invention is to introduce a fundamental architecture for DCHL when its hardware is used in future mobile terminals. This kind of scheduler architecture is required when a mobile terminal accelerated with DCHL is implemented and combined with generic OS. The proposed architecture is the fundamental framework for DCHL. Additionally, improvement methods proposed from other research activities can be integrated into the proposed architecture as one of extension modules.
6. The operating system scheduler (hereinafter OS scheduler) manages all applications that are ordinary applications and multi-media applications using DCHL. The Tire-1 Scheduler gets essential scheduling information about multi-media applications from OS scheduler via the Hook Module (See (a) in Figure 3). The most important information is the scheduling order of applications and those priorities. The scheduling order is needed to decide when 'preloading' is performed for DCHL. The priority of application gives the real priority of algorithm logic to be configured into and executed on DCHL. Since the priority of algorithm logic can't be decided until when an actual application is attached to it, this role of the Tire-1 Scheduler is essential in this sense. The scheduler also gets communication overhead from the device driver abstracting the difference of DCHL hardware (See (d) in Figure 3), which helps to adjust scheduling timing precisely. Additional algorithm can be extended using modules (See (e) in Figure 3). The Tire-2 Scheduler gets requests from the Tire-1 Scheduler (See (b) in Figure 3), then, it schedules actual algorithm logic to be executed inside DCHL (See (c) in Figure 3). To separate scheduler into two layers allows any kind of DCHL to get along with heuristic scheduler on generic OS architecture.
7. Yes. In near future, all mobile terminals are combined with DCHL in order to improve power dissipation and flexibility for new services. At that time, this proposed architecture is needed.

Nokia Research Center, Japan

8 to 11 non.

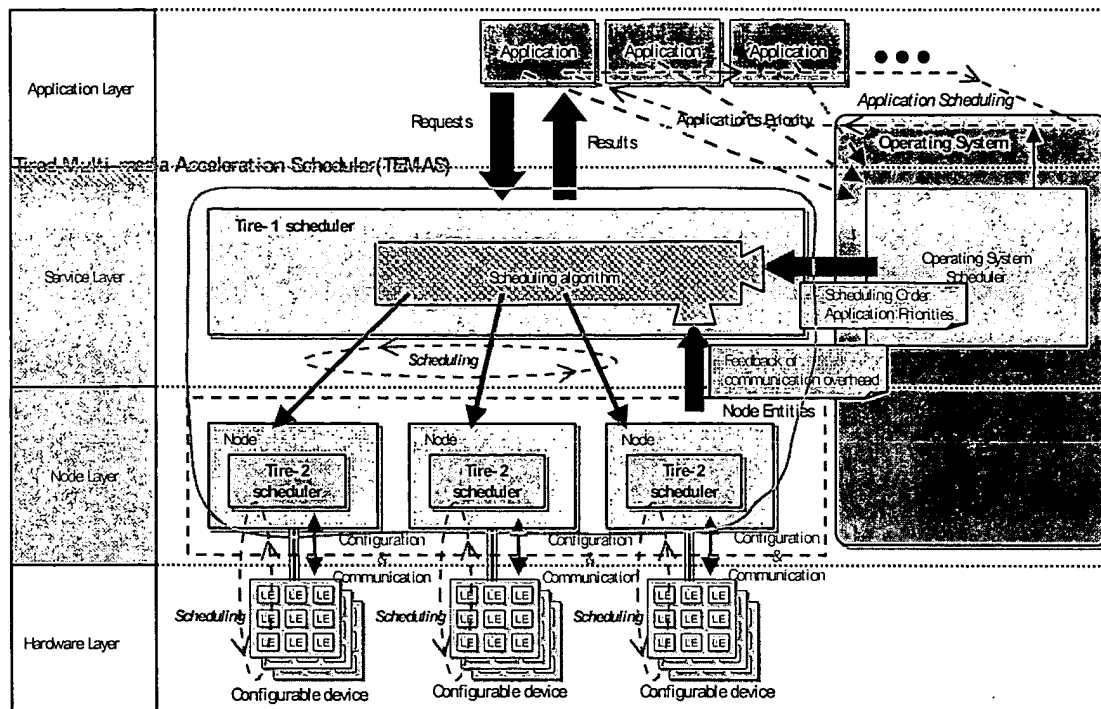


Figure 1. Tired Multi-Media Acceleration Scheduler (TEMAS)

Dynamic Configurable Hardware Logic (DCHL) is,

- It can accept several algorithm logic at the same time
- A algorithm logic can be configured while other logics are working

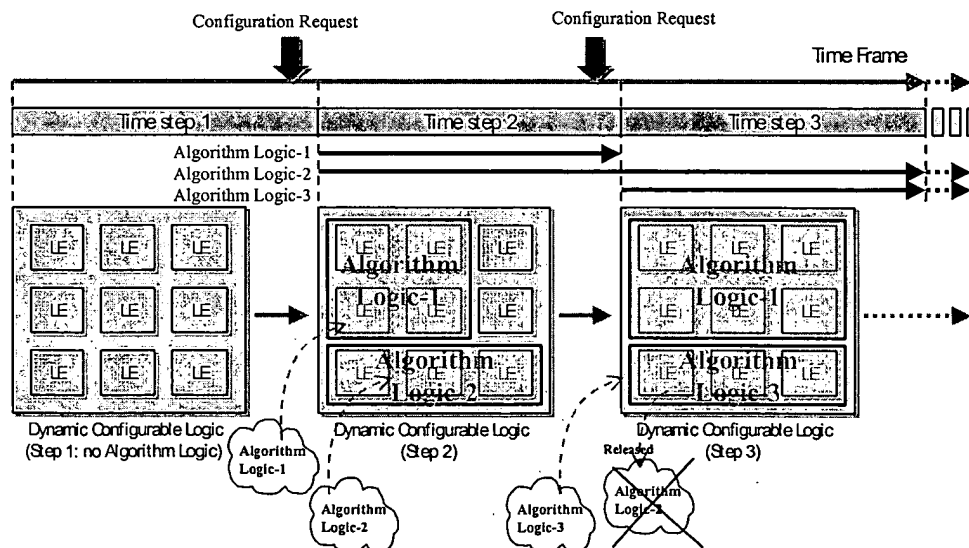


Figure 2. Dynamic Configurable Hardware

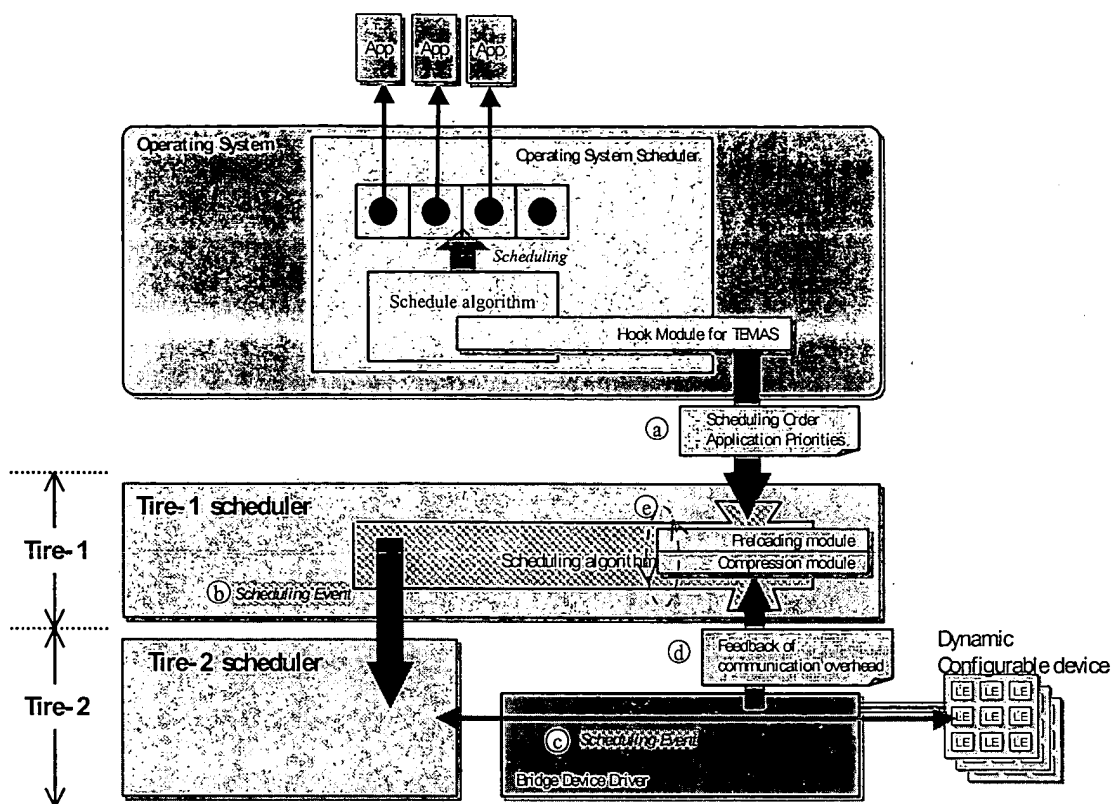


Figure 3. An example of implementation

Why is DCHL Promising?

Acceleration for multi-media applications is needed for future mobile terminal like smart-phone. The reasons are,

- Killer applications such as music player or movie player require so much hardware performance,
- Mobile terminals should be implemented with minimized power dissipation and CPU performance,
- Hardware accelerations are needed to execute applications.

Additionally, configurability is also important because various algorithms such as MP3 decoder or MPEG4 codec are required.

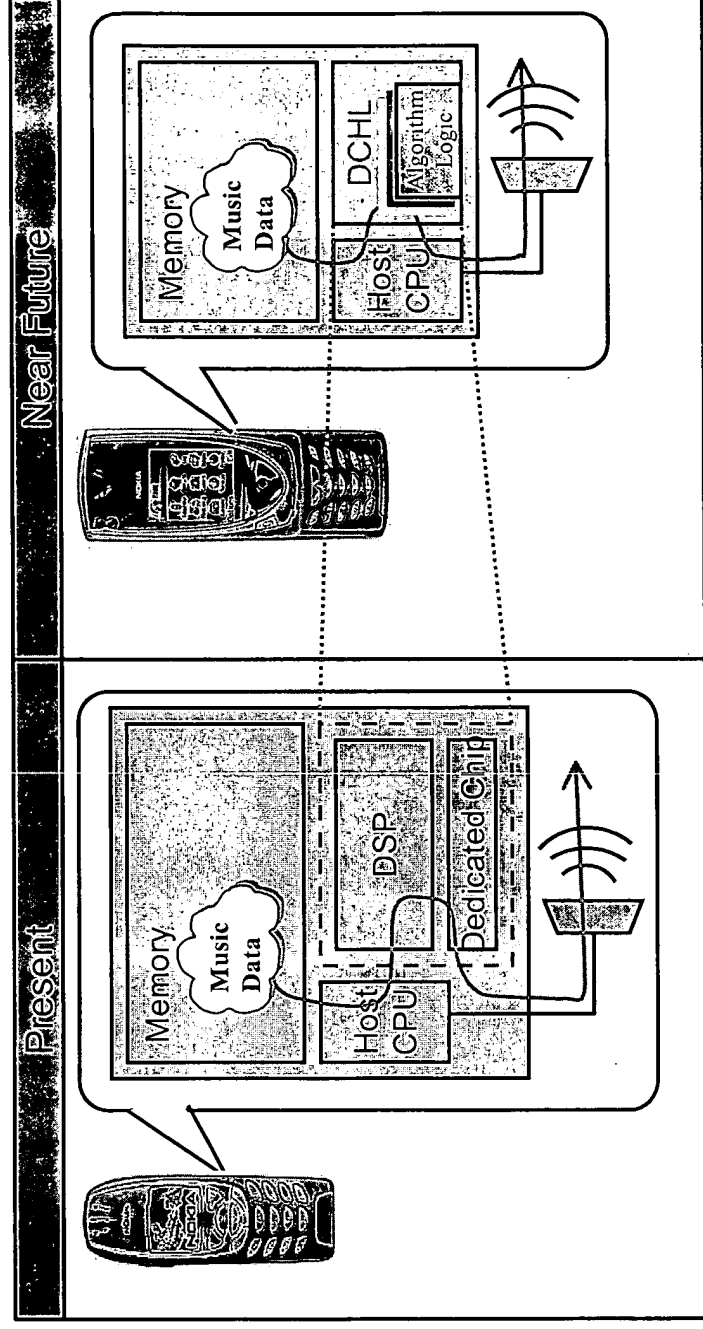


The present terminals are using dedicated hardware or DSP. For example, OMAP processor to be used for next generation's Nokia phones organizes CPU and DSP into a chip. DSP is configurable, but its performance and power dissipation is bad.

Hardware	ASIC	DSP	DCHL
Performance	High	Low	Middle
Power Dissipation	Very Good	Bad	Good
Configurability	No	Yes	Yes

Future Architecture

The present terminals use DSP and dedicated chips like ASIC to get multi-media applications accelerated. In future, DCHL is expected to use instead of those hardware, which enables to balance between low power dissipation and high performance.

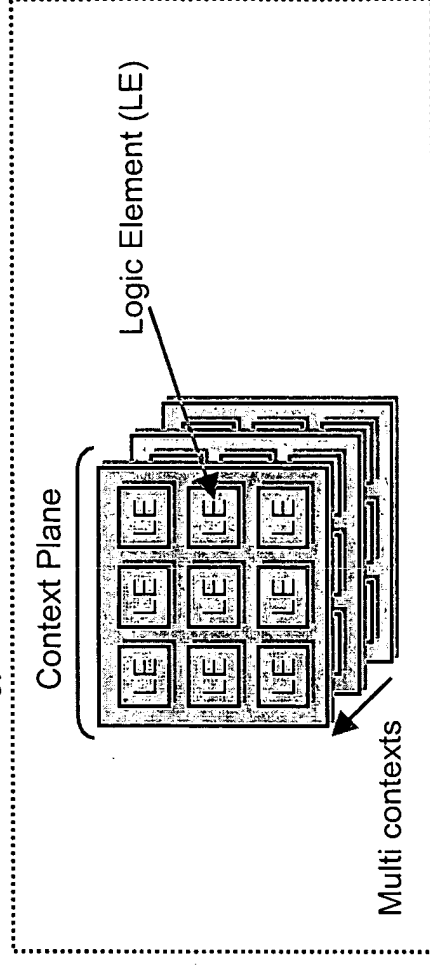


DCHL Features

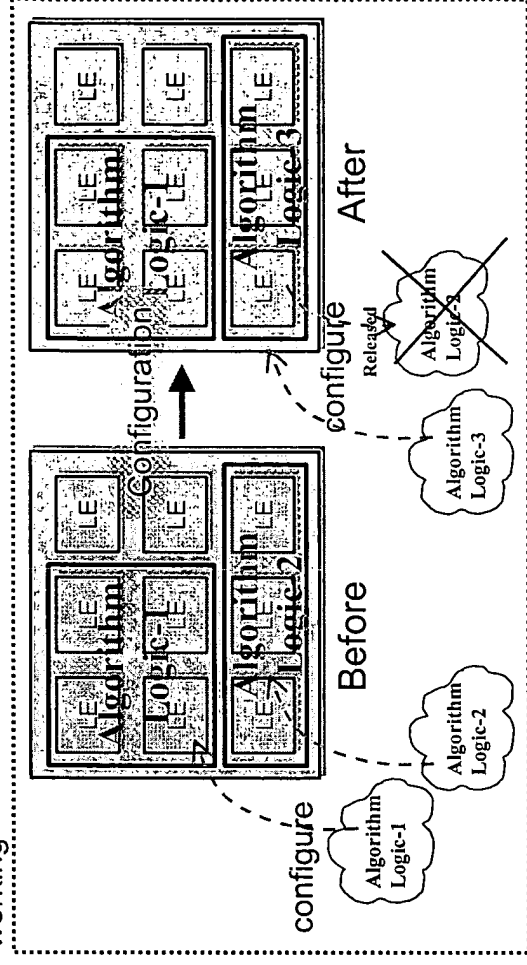
The features of DCHL (Dynamic Configurable Hardware Logic) are,

- LE is a unit to be configured as an algorithm logic
- Some logic elements are contained in a context plane
- Algorithm logic is a set of LEs
- Some contexts may be included within one device
- Some algorithm logics can be configured within one context and working simultaneously
- Any LEs can be configured partially while other LEs are working

• DCHL terminology

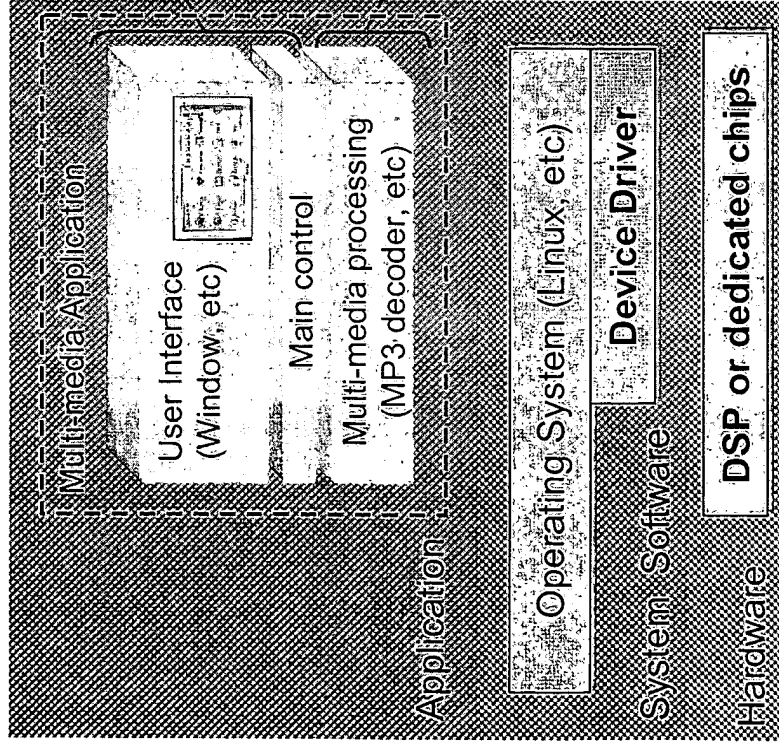


- Any elements can be configured partially while other elements is working

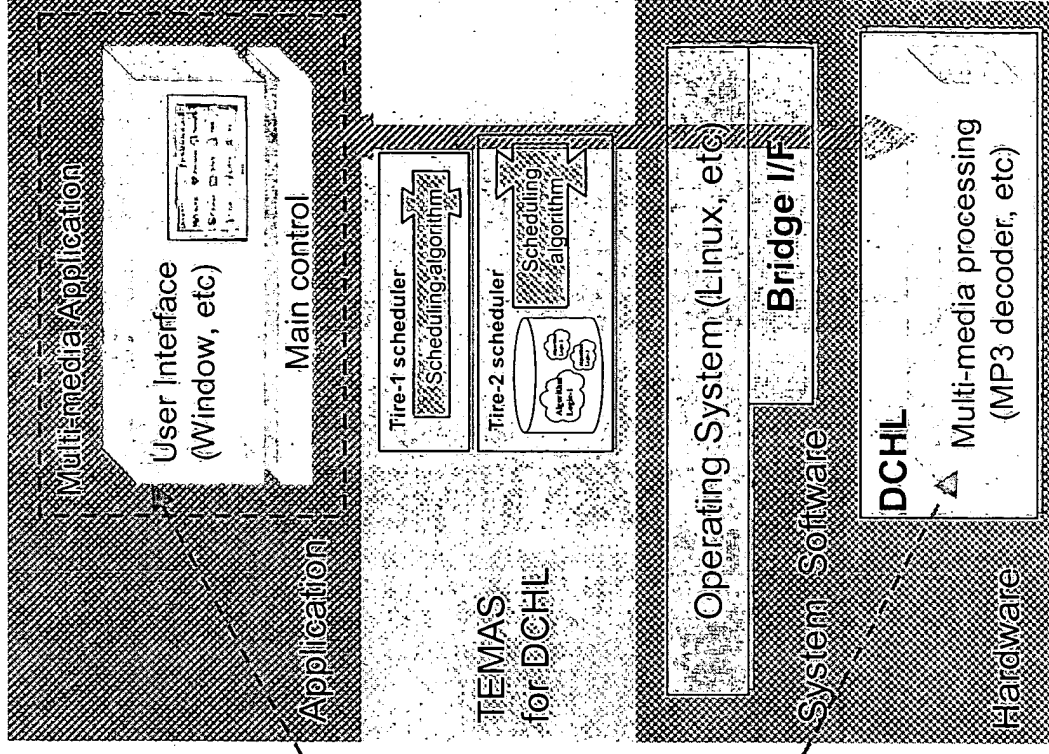


Why is TEMAS needed?

In a system with DCHL, the major part of multi-media application like user interface and main control still works in the application layer. Thus, TEMAS is needed to coordinate communication between application layer and hardware layer.




Multi-media application with present hardware



Multi-media application with DCHL

NOKIA

Patent-Agency Harrington-Smith (EXT-RES/Usa)

From: Kasahara Motohiro (Nokia/Tokyo)
To: Patent-Agency Harrington-Smith (EXT-RES/Usa)
Cc:
Subject: New patent application / NC39080 and NC39081
Attachments:  [IR.zip\(771KB\)](#)

Sent: Fri 12/13/2002 2:35 AM

Dear Mr. Smith,

I would like ask your assistance to file two U.S. patent application for the attached invention report. Two invention reports namely NC39080 and 39081, and supporting material are attached hereto. These inventions should be filed as patent separately.

The due date of these inventions is December 26. Because of very tight schedule, I think these may be filed as provisional patent application.

Please let me know if the above schedule is available, and if it is okay, expected first draft date.

Best regards,

KASAHARA, Motohiro

<< [IR.zip](#) >>

EXHIBIT B